Substitution and food: Toward more sustainable pesticide use

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Substitution and food: Toward more sustainable pesticide use

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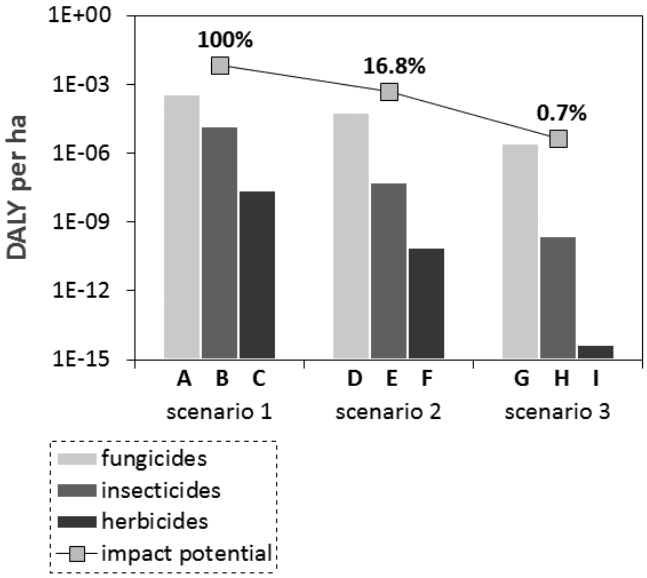
Pesticides authorized the EU are considered safe for humans, i.e. below thresholds of acceptable risk. However, pesticides nonetheless contribute to global human disease burden [1]. Comparative substitution scenarios combining crop-specific amount applied with pesticide-specific toxicity potential can help to characterize and minimize disease burden from pesticide exposure. We identified intake via food crop consumption as main exposure pathway to pesticides. For this pathway, we quantified health impacts in a dynamic crop uptake model, detailing how pesticides contribute to average burden of 2.6 hours lost per person over lifetime across Europe.



fungicides
A : azoxystrobin, cyproconazole
D : epoxyconazole, fenpropimorph, pyraclostrobin
G : chlorothalonil, mancozeb, tebuconazole

insecticides
B : β-cyfluthrin, carbaryl
E : cyhalothrin, esfenvalerate
H : α-cypermethrin, deltamethrin

herbicides
C : fenoxyprop-P, pendimethalin, prosulfocarb
F : glyphosate
I : iodosulfuron, propoxycarbazone-sodium

Figure 1. Human toxicity impact scores of different scenarios expressed in disability-adjusted life years (DALY) per ha of wheat treated with pesticides, and relative impact scores normalized to scenario 1.

Findings show that only 10% of all pesticides applied to grapes/vines, fruit trees, and vegetables account for 90% of total annual health impacts of around 2000 disability-adjusted life years. Main aspect driving crop residue dynamics and parameter uncertainty is thereby pesticide dissipation from crops. Combining improved dissipation data from two recent studies [2,3] with quantitative assessments, we demonstrate that health impacts can be reduced up to 99% by defining adequate substitution scenarios (Figure 1). We recommend that future work focuses on pesticides dominating human disease burden, which has policy implications.